AGS STUDIES REPORT NUMBER 91

Date 7/26→27/77 Time 1200→0400 Experimenters Blumberg, Cahill, Egelman, Eld, Gill Gabusi, LoSecco, Raka, Soukas, Sulak, Weng, Witkover

Subject 1.5 GeV/c FEB Extraction and Emittance

OBSERVATIONS AND CONCLUSION

AGS Conditions: Same as July 1 test but with collimators U5 and U12 open.

Results: (1) We immediately extracted $\sim 3 \times 10^{12}$ ppp and, with minor adjustments, attained a peak intensity of $4.7\ 10^{12}$ ppp. The internal beam (CBM read at ≈ 80 ms after t_o) was $\sim 8 \times 10^{12}$ so extraction efficiency was $\approx 60\%$ compared to $\sim 75\%$ theoretical. Results from a radiation survey after the run showed that E13 straight section activity was quite small (~ 250 mR/hr) compared to 3 R/hr on 5/31/77 after HEP FEB and ~ 25 R/hr on 5/27/77 during FEB run. Thus, the 7-inch ID pipe now in E13 (compared to 5 3/4-inch previously) has eliminated loss. We also noted that the H10 ejector magnet, at its operating position of 2.7-inches upstream and 2.2-inches downstream with respect to beam code axis, was causing some of the early loss -- the CBM had been reading $\sim 1.0 \times 10^{13}$ ppp for HEP (SEB) preceding this study. But the above H10 position is approximately the same as used in HEP neutrino operations. We therefore conclude that, with the machine retuned at injection to FEB values, the AGS could capture about 2×10^{12} more beam.

(2) The beam spot at the U15 flag was horizontally $\sim 50\%$ larger than the elliptical hole in the flag and $\sim$ twice the vertical hole which is 1.36-inch horiz. X 0.3-inch vertical -- the calculated 28.5 GeV/c size with $E_H \times E_V = 2.4\pi \times 1.86\pi$ (mm-mr)^2. The horizontal emittance of $\sim 6\pi$ mm-mr calculated by Weng for 1.5 GeV/c sharing is thus consistent with observation. The spill duration of ~ 10 μsec is also consistent with calculation. The expected vertical emittance, estimated from the 1-inch aperture of the E10 and H10 magnets and size measurements of Raka (1977) and Herrera (1974), is $E_V = 20.7\ \pi$ mm-mrad; thus, the vertical size observed at U15 is much smaller ($\sim \frac{1}{2}$) than expected.

(3) The beam was transported with no observable loss through the $4\frac{1}{4}^o$ bend to U165. The spot size at the U165 flag was about twice the 0.73-inch horiz. X 0.81-inch vert. hole in that flag. The strength required for the 4Q26.5 quadrupoles Q3, Q4 and Q5 was about twice that expected from recent measurements of a spare 4Q26.5 which gave $B_{pole\text{-}tip} = 0.008\ I + 0.032$ kG with I in amps. Note that, at the expected operating current of ~ 5 A, the residual field is comparable to the current-induced field.

(4) Beam profiles were obtained with the single wire SEM at U167 with Q4 and Q5 off and Q3 varied to produce a minimum. The SEM had a wire mesh screen at + bias relative to the wire (0.002" W) and gave much better profiles than on May 9. However, there is still evidence of ion collection on the wire. Also, the minimum width was wider, ~ 1.2-inch, than expected. It was not possible to obtain a believable emittance.

Recommendations

(A) Degauss Q31 to Q7 quadrupoles before next studies. Calibrate a degaussed 4Q26.5 to $\sim 1\%$.

(B) Replace wire mesh with Aℓ foil in SEM to further reduce charge collection. Also, get better vacuum at U167 if possible.

(C) For next run extraction should be on flat top at ~ 134 ms where more stable operation was experienced during 7/27 studies.

(D) Replace U165 flag. The present one has burned spots on it.